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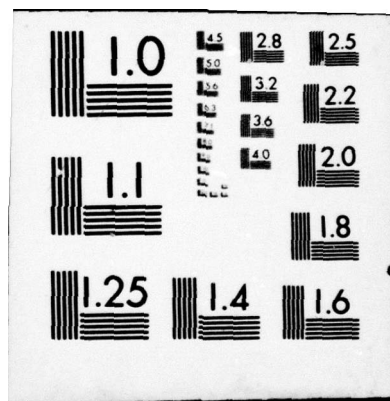
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USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK  
VOLUME 58. U-10B IN-FLIGHT CREW NOISE

AEROSPACE MEDICAL RESEARCH LABORATORY,  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

NOVEMBER 1975

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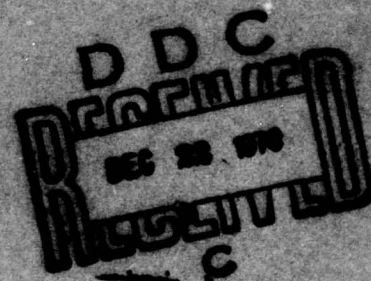
AMRL-TR-75-50  
Volume 58



# USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

Volume 58  
U-10B IN-FLIGHT CREW NOISE

NOVEMBER 1975



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AEROSPACE MEDICAL RESEARCH LABORATORY  
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## FOR THE COMMANDER

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The U-10B is a USAF short-range, light cargo STOL aircraft used in counter-insurgency operations. This report provides measured data defining the bioacoustic environments at flight crew locations inside this aircraft during normal flight operations. Data are reported for one location in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for		

total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

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## **PREFACE**

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 72310418, Measurement of Noise and Vibration Environments of Air Force Operations. Col Justus F. Rose, Jr. conducted the field measurements and performed the data analysis; Capt Nick Farinacci prepared this report.

The authors acknowledge the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.



## Table of Contents

	<i>Page</i>
INTRODUCTION .....	3
IN-FLIGHT NOISE .....	4

## List of Tables

1. Measurement Location and Test Conditions for Noise Measurements .....	4
2. Measured Sound Pressure Level	
1/3 Octave Band .....	5
Octave Band .....	6
3. Measures of Human Noise Exposure .....	7

## INTRODUCTION

The U-10B is a USAF short-range, light cargo STOL aircraft used in counterinsurgency operations. This aircraft, which is manufactured by the Helio Aircraft Corporation, is powered by one GO-480-G1D6 reciprocating engine rated at 295 hp at 3,400 rpm maximum take-off power. The engine drives a Hartzell three-blade constant-speed, 2.44 m diameter propeller through a 0.642 gear reduction. The engine is manufactured by the AVCO Corporation, Lycoming Division.

This volume provides measured data defining the bioacoustic environments produced inside this aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the U-10B aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. *Refer to Volume 1* (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

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1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

## IN-FLIGHT NOISE

### MEASUREMENTS

All noise measurements were made on-board a standard-configured U-10B aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard U-10B environments, but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at one flight crew location. Table 1 lists the measurement location and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone was randomly moved external to the headgear in a region 0.2-0.3 meter from the head and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level that effectively smooths out short-duration fluctuations and best describes the exposure.

### RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the U-10B aircraft at the specified location. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1  
MEASUREMENT LOCATION AND TEST CONDITIONS

U-10B, Hurlburt Fld, 9 Aug 1971 Serial # 63-18090		
LOCATION	POSITION	HEIGHT ABOVE DECK
1	Between Pilot and Copilot	Seated Head Level
CONDITION	DESCRIPTION	
A	Taxiing — 1500-1900 RPM, 13" Manifold Pressure.	
B	Takeoff — 3400 RPM, 26-27" Manifold Pressure.	
C	Initial acceleration, flaps up.	
D	Climb — 2700 RPM, 27" Manifold Pressure, 80 KIAS.	
E	Cruise — 2500 RPM, 20" Manifold Pressure, 90 KIAS, 1100' PA.	
F	Descent — 2700 RPM, 10-15" Manifold Pressure, 80 KIAS, 1100' → 600' PA.	
G	VFR traffic pattern — downwind — 2700 RPM, 15" Manifold pressure, 60 KIAS, ½ flaps.	
H	VFR traffic pattern — base leg and turn to final — 2700 RPM, 15" Manifold Pressure, 60 KIAS, ½ flaps.	
I	VFR traffic pattern — final approach.	
J	Landing roll.	



TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											
2 1/3 OCTAVE BAND											
NOISE SOURCE/SUBJECT: ( OPERATION: ) IDENTIFICATION: )											
U-10B AIRCRAFT											
INFLIGHT NOISE LEVELS											
10 JAN 75											
PAGE F1											
LOCATION/CONDITION											
FREQ (HZ)	1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	
25	96	104	105	102	103	99	98	99	98	96	
31.5	87	109	99	98	95	94	97	91	91	90	
40	86	107	98	95	94	91	89	89	89	86	
50	88	98	96	91	92	88	86	88	87	88	
63	96	95	93	96	92	89	90	96	88	95	
80	109	109	105	101	101	97	92	94	95	105	
100	113	106	103	101	93	96	94	92	90	106	
125	87	95	94	109	105	108	109	91	101	84	
160	82	107	105	101	90	98	99	90	85	87	
200	85	97	94	94	92	88	86	85	87	89	
250	86	101	92	95	90	87	86	82	90	86	
315	88	103	97	91	90	87	83	83	87	82	
400	81	100	97	93	91	86	84	83	87	81	
500	79	97	94	88	86	83	82	81	83	76	
630	74	97	90	88	83	82	81	76	79	74	
800	71	92	89	87	82	80	79	75	77	71	
1000	70	93	90	85	81	78	77	74	74	70	
1250	69	90	87	83	80	78	75	70	72	67	
1600	70	87	84	81	79	76	73	71	71	68	
2000	69	88	84	82	81	78	75	71	72	67	
2500	66	86	82	82	80	77	74	70	70	65	
3150	65	83	81	79	78	75	71	68	68	63	
4000	65	82	80	79	78	74	70	68	67	63	
5000	62	79	76	76	74	70	67	64	64	60	
6300	62	78	75	75	73	70	66	64	63	59	
8000	63	77	75	74	72	70	66	64	63	59	
10000	62	74	73	71	69	66	63	61	60	58	
12500	63	73	71	69	66	63	61	61	60	59	
16000	65	73	72	68	65	63	63	63	63	61	
OVERALL	115	116	112	112	109	109	110	103	105	109	
LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.											



TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											
2 OCTAVE BAND											
NOISE SOURCE/SUBJECT: ( OPERATION: )											
U-108 AIRCRAFT											
INFLIGHT NOISE LEVELS											
LOCATION/CONDITION											
1/A 1/B 1/C 1/D 1/E 1/F 1/G 1/H 1/I 1/J											
FREQ (HZ)											
31.5	97	112	106	104	104	101	100	99	97		
63	109	109	105	102	102	98	99	96	106		
125	113	110	107	110	106	108	96	102	106		
250	91	106	99	98	96	92	88	93	91		
500	83	103	99	95	92	89	87	85	83		
1000	75	96	94	90	86	84	82	79	74		
2000	73	92	88	86	85	82	79	75	71		
4000	69	86	84	83	82	78	74	72	66		
8000	67	81	79	78	76	74	70	68	63		
16000	67	76	74	71	69	66	65	65	63		
OVERALL	115	116	112	112	109	109	110	103	105	109	

IDENTIFICATION:

OMEGA 3.2

TEST 71-014-060

RUN 01

10 JAN 75

PAGE J1

TABLE: MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:	
3										OMEGA 3.2	
										TEST 71-014-060	
NOISE SOURCE/SUBJECT:										RUN 01	
U-108 AIRCRAFT										10 JAN 75	
INFLIGHT NOISE LEVELS										PAGE H1	
LOCATION/CONDITION											
1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J		
HAZARD/PROTECTION											
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR											
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR											
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)											
NO PROTECTION											
OASLC	114	115	111	111	108	109	110	102	104	109	
OASLA	95	104	100	98	95	94	95	87	90	90	
T	71	15	30	42	71	85	71	285	170	170	
MINIMUM JPL EAR MUFFS											
OASLA*	93	92	89	89	86	87	88	78	82	87	
T	101	120	240	202	339	285	240	960	679	285	
V-51R EAR PLUGS											
OASLA*	77	83	78	76	73	72	73	66	69	71	
T	960	571	960	960	960	960	960	960	960	960	
FLENTS EAR PLUGS											
OASLA*	79	83	79	77	74	74	75	67	70	73	
T	960	571	960	960	960	960	960	960	960	960	
H-157 IN-FLIGHT COMMUNICATION UNIT											
OASLA*	92	92	83	89	86	87	88	78	81	87	
T	120	120	202	202	339	285	240	960	807	285	
COMMUNICATION											
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)											
PSIL	77	97	94	90	88	85	83	80	81	76	
ANNOYANCE											
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)											
TONE CORRECTION (C IN DB)											
PNLT	115	120	116	116	114	113	113	102	109	109	
C	3	2	2	1	2	2	2	0	2	2	

\* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

\* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.